

material being placed onto a vibrating screen arrangement with such fine material being deposited directly into the base of the excavated trench with coarser material being returned to the ground adjacent the trench. As the apparatus moves along the trench a degree of levelling of the finer bedding material deposited in the base of the trench is achieved. Thus part of the problems associated with the apparatus disclosed associated with the apparatus disclosed in Australian Patent Specification No. 592815 are resolved, however, there remains the problems of having a trench forming machine undertake a first pass, the bedding material forming apparatus undertake a second pass along the trench and having separate machinery such as a front end loader or the like pick up and deposit excavated material onto the bedding material forming or supply apparatus. These separate handling and operational steps increase the number of operational personnel required, the operational steps involved and the machinery required thereby increasing the time and cost of installing pipelines.

The objective of the present invention is to provide apparatus capable of forming a pipeline trench and laying a pipeline bedding material from the excavated trench material into the trench via substantially a one pass operation without the need to bring to the site separate bedding or pipeline surround material such as sand or the like.

Accordingly, the present invention provides apparatus for forming a trench and preparing a base region of the trench for laying an elongate member such as a pipeline, cable or the like therein, said apparatus including a trench forming machine having excavating means adapted to excavate the trench as the trench forming machine is moved in a forward direction, a bedding material forming means positionable, in use, at least partly above the trench formed by the excavating means of said trench forming machine and being adapted to move simultaneously along said trench with said trench forming machine as the trench forming machine moves in said forward direction, said apparatus further including conveyor means for conveying excavated trench material created by said excavating means to said bedding material forming means, said bedding material forming means including separation means for separating fine particulate material from the excavated trench material delivered thereto by said conveyor means

whereby said fine particulate material is adapted to be delivered to the base region of said trench.

The pipeline bedding material forming means might conveniently be constructed as an integral part of the trench forming machine or alternatively, may be separate from the trench forming machine but pulled along the trench by connection means between the trench forming machine and the pipeline bedding material forming means. In this preferred embodiment, the connection means may be one or more cable(s) or chain(s) extending from a low point within the trench on the bedding material forming means to a more elevated position on the trench forming machine.

Preferred aspects and features of this invention may be as defined in claims 6 to 18 annexed hereto, which claims are hereby made part of the disclosure of this specification.

In accordance with a further aspect, the present invention provides a method of forming a trench and preparing a base region of the trench for laying a pipeline therein, said method including the steps of providing a trench forming machine and excavating ground material from a zone intended to form the trench while moving said trench forming machine in a forward direction, conveying at least a portion of said ground material excavated from said zone intended to form the trench directly to separation apparatus for separating fine particulate material from the excavated ground material and depositing the fine particulate material into the base region of said trench as said separation apparatus is moved along said trench with said trench forming machine.

Preferred features of the foregoing method may be as defined in claims 20 to 23 annexed hereto, which claims are hereby made part of the disclosure of this invention.

By arrangements and methods as disclosed in the foregoing, it is possible to create a trench and simultaneously deposit a pipeline bedding material in the base of the trench during one pass of the machinery, thereby making significant time and cost savings.

In accordance with a still further aspect, the present invention provides a method of laying an elongate member (such as a pipeline, cable or the like) in an underground position, said method including the steps of providing a trench

forming machine and excavating ground material from a zone intended to form a trench while moving said trench forming machine in a forward direction, conveying at least a portion of said excavated ground material from said zone intended to form the trench directly to first separation apparatus for separating  
5 fine particulate material from the excavated ground material and depositing the fine particulate material into a base region of the trench as said first separation apparatus is moved along said trench, laying said elongate member on said fine particulate material in the base region of said trench, and thereafter passing  
10 second separation apparatus along said trench, said second separation apparatus also receiving at least a portion of said excavated ground material and delivering fine particulate material from said excavated ground material into said trench depositing same around and over said elongate member. In a particularly preferred application of this method, the elongate member maybe a pipeline or conduit of continuous length or of joined separate sections.

15 Preferred features and aspects of the aforesaid method may be as defined in claims 25 to 30 inclusive as annexed hereto, the subject matter of these claims being made part of the disclosure of this specification by this reference thereto.

The method as outlined in the previous two paragraphs enables a pipeline, conduit or other elongate member to be positioned underground in an effective  
20 and relatively inexpensive manner when compared with the methods and costs of alternative existing processes to achieve a similar result.

Further preferred features and aspects of this invention will become apparent from the following description of a preferred embodiment given in relation to the accompanying drawings, in which:

25 Fig 1 is a schematic side elevation view of apparatus according to a preferred embodiment of this invention; and

Fig 2 is a partial perspective view of the apparatus of Fig 1.

Referring to the drawings, the apparatus 10 includes a trench forming machine 11 connected via chain means 12 to pipeline bedding material forming  
30 apparatus 13. This apparatus may be generally the same as that shown in Australian Patent Specification No. 18827/02, the disclosure of this specification being hereby included in the current specification to the extent to which it may be necessary to understand any aspect of the present invention. The trench forming

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Apparatus for forming a trench and preparing a base region of the trench for laying an elongate member such as a pipeline, cable or the like therein, said apparatus including a trench forming machine having excavating means adapted  
5 to excavate the trench as the trench forming machine is moved in a forward direction, bedding material forming means positionable, in use, at least partly above the trench formed by the excavating means of said trench forming machine and being adapted to move simultaneously along said trench with said trench forming machine as the trench forming machine moves in said forward direction,  
10 said apparatus further including conveyor means for conveying excavated trench material created by said excavating means to said bedding material forming means, said bedding material forming means including separation means for separating fine particulate material from the excavated trench material delivered thereto by said conveyor means whereby said fine particulate material is adapted  
15 to be delivered to the base region of said trench.
2. Apparatus according to claim 1 wherein said bedding material forming means forms an integral part of said trench forming machine.
3. Apparatus according to claim 1 wherein said bedding material forming means is separate from said trench forming machine but in use is pulled along  
20 said trench by connection means to said trench forming machine.
4. Apparatus according to claim 3 wherein said connection means includes one or more cable(s) or chain(s) extending between said trench forming machine and said bedding material forming means.
5. Apparatus according to claim 4 wherein said cable(s) or chain(s) are  
25 angled downwardly from said trench forming machine to said bedding material forming means with a connection of said cable(s) or chain(s) to said bedding material forming means being below an upper edge of said trench.

6. Apparatus according to any one of claims 1 to 5 wherein said conveyor means includes a first conveyor extending transversely relative to said trench said first conveyor being adapted to receive the excavated trench material from said excavating means and to deliver same to a second conveyor extending rearwardly to said bedding material forming means.
7. Apparatus according to claim 6 wherein said first conveyor is made up of one or more individual conveyor units.
8. Apparatus according to claim 6 or claim 7 wherein said second conveyor is made up of one or more individual conveyor units.
9. Apparatus according to any one of claims 6 to 8 wherein baffle means is provided adjacent the end of said first conveyor whereby excavated material on said first conveyor is deposited on said baffle means if the first conveyor is moved at a speed above a first predetermined limit, and onto said second conveyor if the speed of said first conveyor is below the first predetermined limit, said baffle means being configured to deliver excavated material deposited thereon to a ground position adjacent said trench.
10. Apparatus according to claim 9 further including control means to vary the speed of said first conveyor to thereby selectably vary the amount of excavated trench material delivered by said second conveyor to said pipeline bedding material forming means.
11. Apparatus according to any one of claims 1 to 10 wherein said trench forming machine includes scraper means arranged to push excavated material thrown out of the trench by said excavating means back into the trench to be reprocessed by said excavating means.

12. Apparatus according to claim 12 wherein said trench forming machine is supported on crawler track means on either side of the trench being formed by said excavating means, said scraper means being formed by ground engagable scraper blades positioned rearwardly of each crawler track means and adjacent  
5 to said excavating means.

13. Apparatus according to any one of claims 1 to 12 wherein said pipeline bedding material forming means includes a structure positionable in the trench and configured to enable movement along the trench, said structure having a lower region adapted to receive said fine particulate material from said separation  
10 means and a lower face leading from said lower region through which said fine particulate material is discharged into a bottom region of said trench.

14. Apparatus according to claim 13 further including adjustable levelling means located rearwardly of the discharge of fine particulate material from said lower region of the structure to adjust the depth of said fine particulate material in  
15 said trench.

15. Apparatus according to claim 13 or claim 14 wherein the separating means includes a vibrating screen table that is wider than the trench and is inclined to one side whereby the excavated material deposited thereon that does not pass through the screen table drops from the screen table on said one side to a ground  
20 position.

16. Apparatus according to claim 15 wherein support skids are positioned to engage the ground on either side of the trench and on either side of the bedding material forming means in front of any excavated material falling from the vibrating screen table.

25 17. Apparatus according to claim 16 wherein the height of said support skids relative to the structure within said trench is adjustable.

18. A method of forming a trench and preparing a base region of the trench for laying an elongate member such as a pipeline or cable therein, said method including the steps of providing a trench forming machine and excavating ground material from a zone intended to form the trench while moving said trench forming machine in a forward direction, conveying at least a portion of said ground material excavated from said zone intended to form the trench directly to separation apparatus for separating fine particulate material from the excavated ground material and depositing the fine particulate material into the base region of said trench as said separation apparatus is moved along said trench with said trench forming machine.

19. A method according to claim 18 wherein said separation apparatus includes a portion located in said trench, said portion including means for distributing and levelling the fine particulate material in the base region of the trench.

20. A method according to claim 19 wherein said means for distributing and levelling the fine particulate material in the base region of the trench includes means for creating a groove in said fine particulate material into which the elongate member is laid.

21. A method according to any one of claims 18 to 20 wherein a portion of the excavated ground material is selectively deposited onto the ground adjacent the trench instead of being conveyed to the separation apparatus.

22. A method according to any one of claims 18 to 21 wherein coarser particulate material of said excavated ground material that is not deposited into the base region of the trench is discharged from said separation apparatus onto the ground adjacent said trench.

23. A method of laying an elongate member in an underground position, said method including the steps of providing a trench forming machine and excavating ground material from a zone intended to form a trench while moving said trench forming machine in a forward direction, conveying at least a portion of said

excavated ground material from said zone intended to form the trench directly to first separation apparatus for separating fine particulate material from the excavated ground material and depositing the fine particulate material into a base region of the trench as said first separation apparatus is moved along said trench, laying said elongate member on said fine particulate material in the base region of said trench, and thereafter passing second separation apparatus along said trench, said second separation apparatus also receiving at least a portion of said excavated ground material and delivering fine particulate material from said excavated ground material into said trench depositing same around and over said elongate member.

24. A method according to claim 23, wherein said elongate member is a pipeline or conduit of continuous length or of joined separate sections.

25. A method according to claim 23 or claim 24, wherein said first separation apparatus is part of or operationally connected to said trench forming machine.

26. A method according to claim 25, wherein said first separation apparatus includes a portion located in said trench, said portion including means for distributing and levelling the fine particulate material in the base region of the trench.

27. A method according to claim 26, wherein said means for distributing and levelling the fine particulate material in the base region of the trench includes means for creating a groove in said fine particulate material into which the elongate member is laid.

28. A method according to any one of claims 23 to 27, wherein a portion of the excavated ground material is selectably deposited onto the ground adjacent the trench instead of being conveyed to the first separation apparatus.